Method and Device for Controlling the Driving Dynamics of a Vehicle

The present invention relates to a method for controlling the driving dynamics of a vehicle, in which the steering movement is carried out as a function of a set value, which is calculated as a function of a deviation between a desired value and an actual value of a vehicle state variable.

The invention also relates to a device for controlling the driving dynamics of a vehicle with a controlling unit, which, based on the deviation of an acquired actual value of a vehicle state variable from a predetermined desired value, determines a set value, on the basis of which a steering movement is carried out.

ESP systems, which are used in cars to carry out an electronic stability program (ESP) according to the state of the art intervene for the purpose of stabilizing the vehicle in a brake system and in a combustion motor management. As a result of the interventions, yaw moments are generated in the process, which act against oversteering or understeering of the vehicle

and against interfering moments which cause interfering yaw movements of the vehicle.

A block diagram of such an ESP system is shown in Figure 1. Based on a steering angle δ_{Drv}, which is set by the driver 110 of the vehicle 150, a computer unit 120 in the process, on the basis of a vehicle reference model, determines a reference value $\dot{\psi}_M$ for the yaw rate of the vehicle 150. This reference value $\dot{\psi}_M$ is compared by a control unit 130 with an actual value $\dot{\psi}$ of the yaw rate, which is acquired by the yaw rate sensor. If the difference between the actual value $\dot{\psi}$ and the reference value $\dot{\psi}_M$ exceeds a given threshold value, then, as a function of the deviation from the rule, a set P_{WhlRef} of wheel-specific brake pressures and a motor moment u_{Mot} are determined, and transmitted by another unit 140 as setting signals to the brake system and the combustion motor management of the vehicle 150.

In the control intervention, the current driving situation is also taken into account, which is calculated based on additional data. These data comprise, for example, the brake pressure P_{Drv}, which is set by the driver, the set ω_{Whl} of the different wheel velocities, the vehicle acceleration a_y and, optionally, the set P_{Whl} of the wheel-specific brake pressures, and they allow, for example, the calculation of the vehicle velocity.

However, the brake intervention, which is carried out particularly by the ESP system, can be sensed clearly by the driver as a vehicle deceleration, and therefore, for reasons pertaining to comfort, it can be used only in the area which is critical for the driving dynamics. In the less than critical handling range, setting interventions based on the braking are acceptable only conditionally.

The motor interventions that are carried out are associated with interfering variations of the steering force, and, in addition, because their dynamics are limited as a matter of principle, they do not offer any potential at all for effectively supporting the driver in the handling range.

It has already been proposed to carry out a yaw rate control based on interventions in the steering system of a vehicle and by means of additional steering movements, which are superposed over the steering movement of the driver, to generate a yaw moment which acts against the oversteering or understeering and compensates for interfering moments.

A yaw rate control, which is based on steering interventions, here has the potential of assisting the driver, even in less than critical driving maneuvers, and thus to improve the handling as well as the agility of the vehicle.

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However, the prerequisite is that the additional steering movement of the vehicle's driver is not perceived as an interference.

Therefore, the invention is based on the problem of adjusting steering interventions, which are carried out during the control of the driving dynamics, as harmonically as possible to the steering movements of the driver.

According to the invention, this problem is solved by a method according to Claim 1.

According to the invention, this problem is also solved by a device according to Claim 7.

Advantageous variants of the methods constitute the objects of Claims 2-6.

Variants of the device constitute the object of Claim 8.

Thus, in particular, a method is provided for controlling the driving dynamics of a vehicle, in which a steering movement is carried out on the basis of a set value, which is carried out as a function of a deviation between a desired value and an acquired actual value of a driving state variable, in such a manner that at least one membership degree of an acquired value of a steering angle, which has been set by the driver, and/or of a steering angle gradient, which has been set by the driver, with respect to a given fuzzy set is determined, and a value of the set value is changed as a function of the membership degree.

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The set value is preferably a steering angle, which is set by means of a so-called superposition steering additionally to the steering angle, which is set by the driver, on a steerable wheel of the vehicle.

The invention makes it possible to take into consideration the steering instructions of the driver during the generation of the additional steering movement, and to design the steering interventions for controlling the driving dynamics so they are more comfortable for the driver. As a result it becomes possible to be able to perform control interventions even in less than critical driving situations, and thus to increase the agility of the vehicle.

The set value is preferably a steering angle, which is set by means of a so-called superposition steering additionally to the steering angle, which is set by the driver, on a steerable wheel of the vehicle.

Control interventions for improving the agility of a vehicle are appropriate and advantageous here both in view of the driver's driving pleasure and also in view of the driving safety.

In the case of steering instructions with high steering angle gradients the vehicle reacts with some delay particularly because of the elastic undercarriage elements as well as the vehicle's inertia. The driver perceives this as an indirect reaction behavior and as a loss of driving pleasure. In the case

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of avoidance maneuvers, one also frequently observes that a driver, because of the delay in the vehicle's reactive behavior, chooses excessively large steering angles, so that the delayed vehicle reaction in the end is more vigorous than the driver expects, and the vehicle can become unstable.

Advantageously, using the method according to the invention, one can now carry out autonomous steering interventions to improve the agility and the reactive behavior of a vehicle, and to harmonically adapt to the behavior of the driver.

A special advantage of the invention here consists in that the steering movements of the driver can be classified, as a function of his/her subjective perception, as "strong" or "weak" steering movements with "small" or "large" steering angles and steering angle gradients.

This classification is achieved by describing the linguistic values "small" and "large" with fuzzy sets. The membership of a value, for example, a measured value of a steering angle sensor to a fuzzy set is represented here by the membership degree of the value in this set, which is a function value of a so-called membership function and assumes values belonging to the interval [0,1].

In the context of extensive driving tests, it has been shown that additional steering interventions using additional steering angles of large value are not tolerated by the driver, when he is

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not intervening at all or only slightly via the steering wheel in the steering event. On the other hand, full driving-dynamic support by a driving dynamic controller must occur in driving situations where the driver contributes a considerable effort to the driving.

In a highly preferred embodiment of the method according to the invention, these observations are taken into account by the fact that the set value is changed on the basis of a fuzzy rule, according to which the value of the set value is decreased when the amount of the steering angle which is set by the driver and the amount of the steering angle gradient which is set by the driver are "small."

In this embodiment it is therefore advantageous to determine the membership degrees of the acquired values of the steering angle, which is set by the driver, and of the steering angle gradient, which is set by the driver, in a set of "small" steering angles and "small" steering angle gradients, respectively. This procedure is carried out advantageously using appropriate left-bounded membership functions, where the assigned value is zero for the steering angle, and the membership degree one is assigned to the steering angle gradient, respectively.

The conclusion of the fuzzy rule is advantageously reached by multiplying the value of the set value with a factor, which is

formed appropriately from the membership degrees, so that no defuzzification of the set value has to be carried out.

A particularly good adaptation of the additional steering movement to the steering behavior of the driver is also achieved if, even at low values of the steering angle gradient, which has been set by her, an additional steering movement is carried out, but not in the case of small steering angles.

Therefore, it is advantageously provided that the set of "small" steering angles presents no tolerance in contrast to the set of "small" steering angle gradients.

Another preferred embodiment of the method according to the invention is characterized in that, in addition to the adaptation of the steering interventions to the steering behavior of the driver, an adaptation to the vehicle velocity is carried out.

It was observed that steering dynamic interventions on the steering remain nearly without effect at very "low" velocities, and can therefore be omitted. At very "high" velocities, "small" steering movements are appropriate, to avoid causing instabilities of the vehicle.

In another preferred embodiment of the method according to the invention, the value of the set value is therefore changed as a function of an acquired value of a vehicle velocity.

It is advantageous here for the value of the set value to be changed particularly as a function of the membership degree of

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the acquired value of the vehicle velocity in a set of "mean" velocities.

By an appropriate selection of the membership function of the set of "mean" velocities, one can here advantageously achieve the effect that the additional steering movement is completely suppressed, when the acquired value of the vehicle velocity is below a first limit value and above a second limit value.

Besides the described method, the invention also produces an advantageous device for carrying out the method.

The device for controlling the driving dynamics of a vehicle with a control unit, which, based on the deviation of an acquired actual value of a vehicle state variable from a given desired value, determines a set value, on the basis of which a steering movement is carried out, is characterized particularly in that it contains a fuzzy logic unit for determining the membership degree of a value of the steering angle, which has been set by the driver, with respect to a fuzzy set of "small" steering angles and the membership degree of a steering angle gradient, which has been set by the driver, with respect to a fuzzy set of "small" steering angle gradients, and for changing a value of the set value by linking the membership degrees.

In a preferred embodiment, the device also comprises a logic unit for determining the membership degree of an acquired value

of the vehicle velocity with respect to of "mean" velocities and for changing the value of the set value as a function of this membership degree.

Additional advantages and advantageous variants of the invention can be obtained from the secondary claims in the following description of preferred embodiment examples with reference to the figures.

In the figures:

Figure 1 shows a block diagram of an ESP system according to the state of the art,

Figure 2 shows a block diagram of an ESP system with integrated device according to the invention,

Figure 3a shows a diagram with the temporal variation of the reference yaw rate and the actual yaw rate,

Figure 3b shows an additional diagram with a temporal variation of the reference yaw rate and of the actual yaw rate,

Figure 4 shows a block diagram of the device according to the invention,

Figure 5 shows the membership function of the set of "mean" vehicle velocities,

Figure 6 shows a block diagram of a logic unit,

Figure 7a shows a diagram with the membership function of the set of "small" steering angles,

Figure 7b shows a diagram with the membership function of the set of the "small" steering angle gradients, and

Figure 8 shows a diagram with a hysteresis curve.

The block diagram of an ESP system with integrated device according to the invention, which system is shown in Figure 2, in agreement with the ESP system according to the state of the art, which was described in the introduction, presents a unit 220 for calculating a target yaw rate $\dot{\psi}_M$, a yaw rate controller 230 for calculating a set value as a function of the result of a comparison of the difference between the acquired actual yaw rate $\dot{\psi}$ and the target yaw rate $\dot{\psi}_M$ with a threshold value, and a unit 240 for transmitting the setting signals P_{WhlRef} and u_{Mot} to the brake system and the motor management of the vehicle 250

The input variables for the system also include the brake pressure P_{Drv}, which is set by the driver 210, the steering angle δ_{Drv} which is set by the driver 210, the measured actual yaw rate $\dot{\psi}$ of the vehicle 250, the measured transverse acceleration a_y, the set ω_{Whl} of the wheel velocities, and the set P_{Whl} of the wheel-specific brake pressures of the vehicle 250.

The known device is completed here according to the invention by the control unit 260, the logic units 270 and 280, as well as a superposition steering 290. The output variables of the device which has been expanded in accordance with the

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invention are the set P_{WhlRef} of the wheel-specific brake pressures, the motor moment u_{Mot}, and, in addition, a steering angle δ_{Whl}, which is to be set on the steerable wheels of the vehicle 250, and in front of the steering gear of the steering of the vehicle 250.

As a result of the superposition steering 290, an additional steering motion on the basis of an additional steering angle $(\Delta\delta_{add})$ is superposed over the steering motion which has been initiated by the driver 210 of the vehicle 250.

The steering angle δ_{Whl}, which occurs in front of the steering gear of the vehicle 250, for example, on a steering pinion of a toothed rod steering, is obtained from the sum of the steering angle δ_{Drv}, which is set by the driver, and the additional steering angle $(\Delta\delta_{Add})$, and it is transferred by the steering gear to the steerable wheels of the vehicle 250. In the process, the steering gear provides a steering translation i, so that the result is a steering angle of δ_{Whl}/i at the steerable wheels of the vehicle 250.

The superposition steering 290 has an electromechanical actuator, which intervenes, via a drive, in the steering line of a conventional hydraulic or electric power steering. The drive can be, for example, a planet gear, where the steering pinion can

be rotated by the insertion of the actuator opposite the steering wheel.

However, additional steering movements can also be generated in a so-called steer-by-wire steering system, in which a mechanical connection between the steering wheel and steering gear is replaced by electromechanical connections. Such a steering system is also appropriate for use in the context of the invention.

In addition, the superposition steering 290 can be equipped with a function of a freely selectable steering translation i between the driver instruction δ_{Drv} and the wheel strike angle.

This function can be carried out by the unit 300, for example, to achieve a velocity-dependent steering translation i, where, in the lower velocity range, a very immediate translation i is set, to facilitate the maneuvering for the driver, and in the upper velocity range, a very indirect translation is chosen, to ensure a problem-free straight movement of the vehicle 250.

For this purpose, the unit 300 calculates the steering angle $\delta_{VARI} = ü_{VARI} \cdot \delta_{Drv}$ based on a velocity-dependent factor $ü_{VARI}$, and it transmits said steering angle to the actuator of the superposition steering 290, which sets a steering angle δ_{Whl} on the steering gear, which steering angle corresponds to the sum of the steering angle δ_{VARI} and the additional steering angle $\Delta\delta_{Add}$.

It is preferred for the invention to be applied to vehicle 250 with four wheels on two axles. Steering interventions can here be carried out both on the front axle as well as on the rear axle, or simultaneously on both axles of the vehicle 250.

Autonomous steering interventions to improve the agility of a vehicle 250 are appropriate to increase the driving safety and the driving enjoyment for the driver 210 and they improve the vehicle's reaction behavior, which is delayed particularly in the case of steering instructions with large steering angle gradients $\dot{\delta}_{Drv}$ because of the elasticity of undercarriage elements, such as, the tires and the rubber bearings, as well as the vehicle's inertia due to the inertial moments, and the high and longitudinal axis, respectively.

A target or desired vehicle yaw rate $\dot{\psi}_M$, which corresponds to the steering angle δ_{Drv} which is set by the driver 210, is compared to the delayed vehicle actual yaw rate $\dot{\psi}$, in the diagram of Figure 3a.

With reference to the figure, it becomes clear that there is a phase delay Δt in the vehicle's reaction. With regard to the agility, the driver 210 of the vehicle 250 perceives this delay as an indirect reaction behavior and thus as a loss of driving pleasure.

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The phase delay Δt in the vehicle's reaction, however, can also lead to situations that are critical for the safety. For example, if a driver 210 must rapidly avoid an obstacle, he tends, as a rule, to "oversteer" due to the delayed vehicle reaction behavior, to set the desired value $\dot{\psi}_0$ for the yaw rate $\dot{\psi}$ on the vehicle 250 at a certain time t_0. If the total vehicle reaction, which results from the driver's instruction, occurs then at time $t_0 + \Delta t$, it is much more violent than expected by the driver, so that he/she often loses control of the vehicle. In the diagram of Figure 3b, the yaw rate increase $\Delta\dot{\psi}$ is shown, which results from "oversteering."

In the above described device to improve the vehicle's reaction behavior, the target yaw rate $\dot{\psi}_M$, which is calculated in the ESP steering apparatus 220 in the vehicle reference model, and which should be applied to the vehicle 250 based on the steering angle δ_{Drv}, which is set by the driver 210, is used for the calculation of the additional steering angle $\Delta\delta_{Add}$.

The vehicle's target behavior is established by the vehicle manufacturer in accordance with his/her philosophy and it is deposited in the unit 220 in the form of software parameters.

In carrying out the control of the driving dynamics, the actual vehicle reaction behavior during the driving is monitored

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continuously by a yaw rate sensor, which determines the current

vehicle actual yaw rate $\dot{\psi}$.

As a function of the control deviation e between the target

reaction and the actual reaction, an additional steering angle

$\Delta\delta_{Add}$ is calculated. By means of the superposition steering 290,

an additional steering movement on the basis of the additional

steering angle $\Delta\delta_{Add}$ is then superposed over the steering motion,

which is initiated by the driver 210 of the vehicle 250, so that,

in front of the steering gear of the vehicle, a steering angle

δ_{Whl} is produced, which corresponds to the sum of the steering

angle δ_{Drv}, which is set by the driver 210, and the additional

steering angle $\Delta\delta_{Add}$.

If a variable, for example, velocity-dependent, steering

translation is integrated in the system network, the angle that

is added is not the steering δ_{Drv}, which is set by the driver 210,

rather the value δ_{VARI} which has been multiplied with the

translation factor $\ddot{u}_{VARI}$ is added to the additional steering angle

$\Delta\delta_{Add}$.

For the determination of the additional steering angle $\Delta\delta_{Add}$,

three blocks 260, 270 and 280 are provided, which are represented

again in Figure 4 and described in greater detail below.

The input variable of the unit 260 ("Adaptive Controller")

represents the control deviation e between the reference yaw rate

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$\dot{\psi}_M$ of [sic; and] the measured vehicle actual yaw rate $\dot{\psi}$, which is calculated as the difference between these two values by a subtractor 310. The unit 260 contains a controller for the calculation of a set value u, which is preferably a proportional controller with a differential component (PD controller).

The latter calculates the set value u according to the time function,

$$u = K \cdot e + T_d \cdot \dot{e}$$

where $\dot{e}$ represents the derivative with respect to time of the deviation e.

The controller parameters K and T_d are not preset here, rather they can be adapted by an adaptation mechanism to the actual driving condition. For example, different controller parameter sets RP are used in the noncritical and the critical driving ranges. It is also possible to apply an adaptation to the loading state of the vehicle 250.

The next block 250 ("Consideration of vehicle velocity") adapts the setting signal u, which is calculated by the block 260, to the current vehicle velocity v_{veh} whose value is determined from the measurement signals of the wheel rpm sensors.

It was observed that driving-dynamic interventions on the steering have nearly no effect at very low velocities, and that

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they have to be reduced at high velocities, to avoid causing instability of the vehicle.

Therefore, in the first step, the membership degree λ_v of the current value of the vehicle's velocity v_{Veh} in a set of "mean" velocities is determined. The membership function λ_v, whose function values give the membership λ_v, is represented in the diagram of Figure 5.

The membership function λ_v is trapezoidal here: if the value of the vehicle's velocity v_{Veh} is below the value v_{low} or above the value v_{high}, a membership degree of $\lambda_v = 0$ is obtained. The parameters v_{low} and v_{high} assume, for example, values of 30 km/h and 200 km/h. Full membership with membership degree $\lambda_v = 1$ in the set of the "mean" velocities, on the other hand, exists if the vehicle's velocity v_{Veh} assumes values between v_{n1} and v_{n2}.

The above-mentioned observation with regard to the effectiveness of the steering interventions leads to the fuzzy rule "IF the vehicle's velocity v_{Veh} is "low" or "large," THEN the set value u assumes the values u = 0."

The conclusion of the rule is achieved in a simple manner in a second step by the fact that the setting signal u is multiplied with the membership degree λ_v, which is determined in the first step. The output variable of the unit 270 is thus the signal u_v with

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$$u_v = \lambda_v \cdot u$$

The signal u_v is then processed by the unit 280 ("Activation Logic"), which is composed of two nonlinear blocks 330 and 340, and which is illustrated in the block diagram in Figure 6.

The block 330 weights its input signal u_v in accordance with the steering activities of the driver 210 and it generates the continuous intermediate value u_{fuz}. Based on a nonlinear hysteresis function u_{dig}, a digital signal u_{dig}, which can assume only the values zero and one, is then calculated in the block 340, and it is linked with the signal u_{fuz} to determine the additional steering angle $\Delta\delta_{Add}$.

In the context of extensive driving tests it has been found that steering interventions with large additional steering angles $\Delta\delta_{Add}$ are not tolerated by the driver 210, if he himself does not intervene or intervenes only slightly via the steering wheel in the steering event. On the other hand, full driving-dynamic supports on the part of the dynamic controller must be provided in a driving situation where the driver 210 exerts a considerable steering effort. In order to design the external steering interventions of the control system so that they are comfortable with a view to the driver 210, the driving instructions of the driver 210 are therefore taken into consideration in the generation of the additional driving angle $\Delta\delta_{Add}$.

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The driving effort is here characterized by the amount $|\delta_{Drv}|$ of the steering angle δ_{drv}, which is set by the driver 210, and the amount $|\dot{\delta}_{Drv}|$, of the steering angle gradients $\dot{\delta}_{Drv}$, which is set by the driver 210.

Similarly to the procedure used for the adaptation of the set value u to the vehicle's velocity v_{Veh}, the intermediate value u_{fuz} is also calculated by the block 330 based on the fuzzy rule. Here the fuzzy rule is:

"IF the amount $|\delta_{Drv}|$ of the steering angle δ_{Drv} is "small," AND the amount $|\dot{\delta}_{Drv}|$ of the steering angle gradient $\dot{\delta}_{Drv}$ is "small," THEN the value u_{fuz} is also "small"."

This rule is a short and pithy formulation of the above described requirements for the determination of the amount of the addition steering angle $\delta\Delta_{Add}$. The linguistic value "small" for the amounts $|\delta_{Drv}|$ and $|\dot{\delta}_{Drv}|$ is here described again by a fuzzy set.

The membership function λ_1 of the set of the "small" amounts $|\delta_{drv}|$ is represented in the diagram of Figure 7a. The diagram of Figure 7b shows the membership function λ_2 of the set of the "small" amounts $|\dot{\delta}_{Drv}|$.

The membership functions here have left-side boundaries: A membership degree λ_1 in the "small" amounts $|\delta_{Drv}|$ which is

different from zero occurs only if the amount $|\delta_{Drv}|$ of the steering angle δ_{Drv}, which is set by the driver 210, is smaller than a value δ_2, and a membership degree of $\lambda_1 = 1$ occurs if the amount $|\delta_{Drv}|$ of the steering angle λ_{Drv}, which is set by the driver 210, is smaller than a value δ_1. The parameters δ_1 and δ_2 assume values of 5° and 15°, for example.

The membership function λ_2 is indicated as a triangular membership function which has a left-side boundary. A membership degree λ_2 which is different from zero occurs only if the steering angle gradient $\dot{\delta}_{Drv}$, which is set by the driver 210, has an amount which is smaller than a value $\dot{\delta}_1$, and a membership degree of $\lambda_2 = 1$ occurs only for $\dot{\delta}_{Drv} = 0$.

Once the membership degrees λ_1 and λ_2 have been determined by the block 330, the AND operation of the above-mentioned rule is reproduced in the next step. For this purpose, the membership degrees λ_1 and λ_2, as is conventionally done in fuzzy logic, are linked by a minimum operation. In the process, the value λ is calculated by

$$\lambda = \min \{\lambda_1, \lambda_2\}.$$

If the value of λ is close to the value one, this means that the steering effort performed by the driver is small, and the conditions for a considerable weakening of the setting signal u_v

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are satisfied. On the other hand, if the value of ë moves around the value zero, the driver is exerting a considerable steering effort, and the additional steering angle $\Delta\delta_{Add}$ should be taken fully into account.

The value u_{fuz} is thus calculated as follows:

$$u_{fuz} = u_v \cdot (1 - \lambda)$$

For the determination of the additional steering angle $\Delta\delta_{Add}$ to be set, the signal u_{fuz} is finally processed by the block 340. The latter block determines the value u_{dig} based on the hysteresis curve, shown in Figure 8, from the signal u_{fuz}, and the additional steering angle $\Delta\delta_{add}$ is then determined by multiplying the set value u_{fuz} with a value u_{dig}. This multiplication is carried out by multiplier 350.

If the input signal u_{fuz} of the block 340 exceeds a value u_2, the output signal $u_{dig} = 1$ and it keeps this value until u_{fuz} becomes smaller than a value u_1.

The signal u_{dig} thus represents an additional request signal, a so-called request flag, by means of which an additional evaluation of the setting requests is carried out. Very small setting requests are suppressed particularly strongly here, if they result in a value of $u_{dig} = 0$, and they lead to no actuator activity at all in the superposition steering 290.

This measure reduces the setting effort of the actuator and, in setting systems with haptic feedback on the steering wheel, it has the advantage that the steering feeling is considerably improved for the driver 210. Small additional steering interventions, which are essentially negligible for the dynamics of the vehicle 250, are completely suppressed and thus they are not perceived by the driver as interfering variations in the moment on the steering wheel.

The value $\Delta\delta_{Add}$, which is calculated by multiplying u_{dig} and u_{fuz}, is then sent as a setting request to the actuator of the superposition steering 290. Thus, it represents the output variable of the described device.

The vehicle 210, while performing the task of steering the course in the less-than-critical driving range, is effectively supported by the external steering interventions which are calculated by the control system. The agility of the vehicle is increased, and excessive steering, for example, during avoidance maneuvers, is prevented.

As a result of the harmonic adaptation of the individual control components and the adaptation of the steering intervention to the vehicle's velocity v_{Veh} and particularly to the activities of the driver 210, the generated additional steering intervention is not perceived by the driver 210 and does not affect him. Moreover, an increase in the steering reactivity

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due to the handling controller is prevented by an intelligent activation mechanism.

In critical driving situations, the steering interventions according to the invention can be combined with conventional brake and motor intervention of an ESP system, in order to be able to control the steering intervention better than by interventions on the brakes and motor alone.

As a result of the use of such steering interventions, the interventions become only necessary at a later time.

Thus, the invention provides an advantageous, yaw rate-based control system, by means of which, based on the driver's instruction and the vehicle reaction which is determined by sensors, additional steering angles $\Delta\delta_{Add}$ in the noncritical driving situation can be calculated, which perceptibly improve the vehicle reaction behavior for the driver 210. The advantages of the invention here include an increase in comfort, particularly an increase in agility, and also an increased safety for the vehicle 250.